1991
Striped Bass
Fisheries Monitoring Report

Massachusetts

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Introduction

This report characterizes the commercial and recreational striped bass fisheries that were conducted in Massachusetts during 1991. The information was collected from monitoring programs which are considered to be essential elements of the long-term management approach as described by Section 7 of the Atlantic States Marine Fisheries Commission's (ASMFC) Fisheries Management Report No. 15 (Supplement to the Striped Bass FMP-Amendment #4). Several sources of information (Table 1) have been examined to estimate harvest levels, levels of total catch (which include fish that are caught but released alive, primarily fish of sub-legal size), and catch composition (size, sex, and age). These include, Massachusetts Division of Marine Fisheries (DMF) and National Marine Fisheries Service (NMFS) based programs (Diodati, 1990).

Harvest and Losses

Commercial Fishery

The proposed and actual season attributes for the 1991 commercial fishery are summarized in Table A. Striped bass dealers were required to obtain a special authorization from the DMF in addition to standard seafood dealer permits. Dealer reporting requirements

included bi-weekly telephone reports of all striped bass purchases (a toll-free number was supplied for this purpose). The frequency of reporting was increased to weekly as the season landings cap was approached. They were also required to provide a written transcript consisting of dates of purchase, number of fish, pounds of

Table A. Season Attributes

	Proposed	Actual
Season	1 Jul-30 Sep	1 Jul-28 Aug
Cap	238,000 lbs	234,800 lbs
Gears	Hook & Line	Hook & Line
Min. Sz.	36 in. (Tl)	36 in. (Tl)

fish and names and permit numbers of fishermen that they purchased from. Transcripts were to be forwarded to the DMF within 15 days following the close of the season.

Fishermen needed both a commercial fishing permit and special striped bass fishing permit to sell their catch. They also had to file catch reports at the end of the season, which included the name of the dealer(s) that they sold to as well as extensive information describing their catch composition and catch rates. A number of fishermen provided personal fishing diaries (voluntarily). In addition, the regulation required that fishermen sell only to authorized Massachusetts striped bass dealers.

Harvest Levels and Catch Composition

Ninety two dealers were authorized to purchase striped bass during 1991. The dealer telephone survey provided the measure of harvest necessary to gauge the distance to the harvest cap, while the dealer written transactions provided the final estimate of the commercial harvest (234,800 pounds).

A third estimate of striped bass harvest was provided by fishermen reports. This level was 220,126 pounds with a reporting rate of 88%; 1739 permits were issued. Since 1991 fishermen reports are still being received, it can be expected that the final harvest estimated from this method will closely approximate the 234,800 pounds indicated above. Fishermen reports also provided information on the disposition of the catch (fish sold, released sub-legals, etc...). To estimate the total catch weight by category, the catch weights for each grouping were increased by 7%, the fraction of under-reporting between dealer and fishermen transactions (1 minus

(220,126 divided by 234,800)).

To estimate catch in number of fish at size, sample size distributions for each category of catch were examined. A weight distribution of 1,259 fish (28,481 lbs) derived from dealer written transactions was used to estimate the catch composition of the SOLD harvest. Each weight was converted to an equivalent length based on the following expression:

$$W = .000184L^{3.19} \tag{1}$$

where W is weight in pounds and L is length in inches (Tl). Information collected from 456 fish sampled in the 1990 and 1991 Massachusetts commercial fishery was used to develop the weight-length relationship. Number of fish at each resulting length interval was weighted by the ratio of catch weight:sample weight to estimate total numbers of fish at size. Similarly, using sample weight distributions derived from fishermen catch reports, catch in number at size was estimated for the categories of LEGAL-SIZE RELEASED (sample size = 94 fish, 2,155 lbs) and fish harvested but NOT SOLD (sample size = 282 fish, 7,064 lbs). Catch in number for SUB-LEGAL RELEASED fish was estimated from a sample length distribution (sample size = 202 fish, 1,596 lbs) provided in 50 fishermen (voluntary) diaries.

Tables 2 and 3 display the catch composition by disposition of catch for the commercial fishery in numbers and pounds of fish, respectively (Figure A). The total catch of 111,728 striped bass (1,126,910 lbs) was dominated by the SUB-LEGAL RELEASED category, 86% by number (95,748 fish) and 67% by weight (757,200 lbs). In 1990, the SUB-LEGAL RELEASED catch consisted of 90% by number (71,674 fish) and 75% by weight (736,647 lbs) of the total catch (Diodati and Hoopes 1991). Thirteen percent of the catch was greater than legal size (36 inches) in 1991, as compared to 10% in 1990.

Figure A. Disposition of Catch.
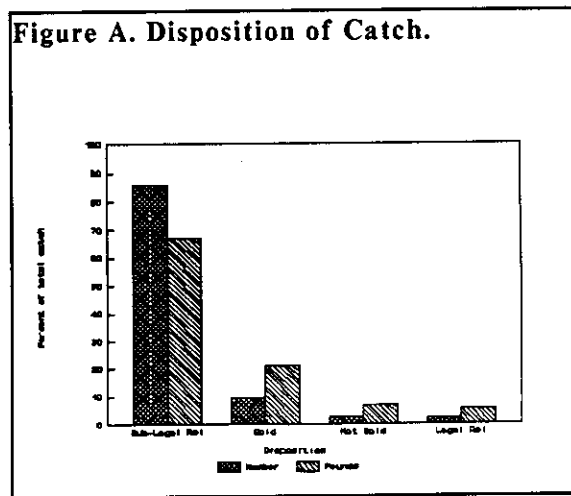
Age and Sex Composition

Age was determined by examination of scales and sex by visual inspection of gonadal tissue (Sykes Method). Two hundred eleven striped bass sampled from the commercial fishery (at dealerships) had an age distribution ranging from 7 to 20 years (Table 4). Age nine (1982 year class), the median age, dominated the distribution (38%).


Figure B. Age Composition
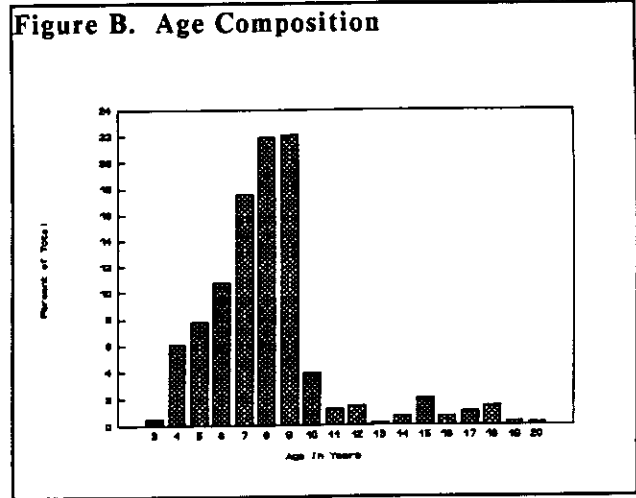
This sample also provided information on sex composition, however field biologists had difficulty determining the sex of 58 fish. For the fish that were sexed, 98% were females. It is unlikely that all the fish of unknown sex were males, since the resulting proportion of females (71%) would then drop well below the range of estimates determined from this fishery during 1982-1990 (84% to 92%). An average between the two values (98% and 71%) might provide a better estimate of the proportion of females in the catch (geometric mean = 83%).

Figure C. Striped Bass Growth Rates

Age of 346 striped bass collected by hook and line during a Massachusetts tagging study in October and November 1991 was also examined (Table 5). This age distribution ranged from 3 to 17 years with age 7 (1984 year class) predominating.
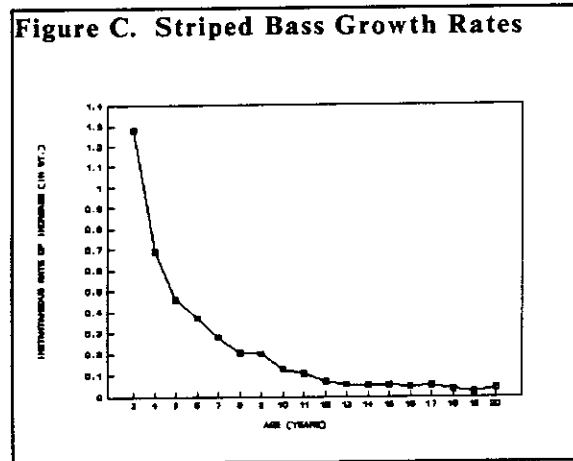
Age data from the tagging study was combined with that obtained from the commercial fishery (Figure B.) and back-calculated length at age was determined for the resulting distribution of 557 fish (Table 6). Growth rates, as instantaneous increase in weight, were derived from the combined data (Figure C).

Estimation of Effort

A total of 1,739 striped bass fishing permits were issued. Of these, 1,530 anglers (88%) have provided catch reports. Catch report information WITH respect to effort was increased by 12%, the fraction of non-reporters. Catch reports provided estimates of effort in hours fished. From voluntary dairies, an estimate of hours per trip was obtained. Total hours spent fishing amounted to 82,896 and the hours per trip averaged 4.65. Therefore, trips totaled 17,827 (82,896 h divided by 4.65 h/trip). CPUE in trips was 6 fish (111,728 fish divided by 17,827 trips) and CPUE in hours was 1.35 fish (111,728 fish divided by 82,896 h).

Characterization of Losses

Potential background mortality as a result of hook and release fishing and poaching of sub-legal striped bass was estimated in both the commercial and recreational fisheries. An investigation of several netting operations chosen because of their proximity to well known striped bass migration routes and periods, found neither direct or indirect estimators of background mortality as a result of illegal fishing operations (primarily netting) or bycatch.

Sub-legal losses attributed to hook-release mortality were estimated using a hook-release mortality rate (h) of 0.08 (Diodati, 1990). Several sources of information were examined to estimate a poaching mortality rate (p). The ASMFC Striped Bass Poaching Sub-Committee report (Sept 1991) showed, that based on law enforcement records, striped bass violations have occurred at an average rate of 15% in recent years. This suggests that 15% of striped bass trips are involved in non-compliance. For the commercial fishery, this was equivalent to 2,674 trips (17,827 trips x 0.15). Since the average catch per trip was estimated at 6 fish, then the total catch involving violations was 16,044 fish (2,674 trips x 6 fish/trip). MRFSS intercept information collected in Massachusetts during 1991 showed that 16% of the A and B_1 type catch was under-sized (Osborn 1992). Therefore, the total number of poached fish was estimated to have been 2,567 fish (16,044 fish x 0.16). A poaching rate of 0.03 was then estimated as the fraction of the total catch of sub-legals that was harvested (2,567 divided by 95,748).

With values for (h) and (p) determined, a conditional mortality rate (T) was developed

based on the expression:

$$T = h + p - (h*p) \tag{2}$$

Given that h and p were equal to 0.08 and 0.03 respectively, T was equal to 0.10. The conditional mortality rate (0.10) was then applied against the total catch of SUB-LEGAL RELEASED (95,748 fish) to estimate the total loss due to release and poaching mortality. The combined loss totaled 9,997 fish. Since poaching represents 27% of the total mortality (0.03 divided by (0.03 + 0.08)), the amount of fish lost to poaching was estimated to have been 2,726 fish (9,997 fish x 0.27); the remainder, 7,271 fish, was lost as a result of release mortality.

Loss as a result of release mortality of LEGAL SIZE RELEASED fish was estimated simply as total catch of LEGAL SIZE RELEASED x 0.08 (or 203 fish). The length and weight distributions for all losses were estimated using the same techniques described in previous sections (Table 7).

Recreational Fishery

The Massachusetts 1991 recreational striped bass fishery had no seasonal restrictions, nor were recreational anglers required to obtain a fishing permit. Catch was restricted to 1 fish per angler per day and a 36 inch minimum size (Tl) was maintained. Harvest levels and total catch were estimated from the NMFS MRFSS. Since 1988, annual MRFSS estimates of Massachusetts striped bass catch (in numbers of fish) have achieved a percent standard error (pse) of 16 or less. The same sources of information and techniques described in previous sections, were used to characterize the size distribution of the recreational catch.

Harvest levels

The MRFSS preliminary estimate for total catch in number (including fish released) is 582,129 striped bass (pse = 14.2). Only fisherman catch reports (described in the previous section) that indicated no bass were sold (475 anglers), were examined to estimate the proportion of sub-legal size fish in this catch. This group reported that 92% of the bass they caught were of sub-legal size. The assumption that this fraction is proportional to the recreational fishery seems reasonable, since recent recreational fishing surveys conducted in

Rhode Island, New York, and Connecticut waters reported a similar range, 94%-97% (Crecco, pers. comm.). The catch of SUB-LEGAL RELEASED was therefore estimated to have been 536,723 fish (528,129 x 0.922).

This report relied on the MRFSS estimate for HARVEST (25,959 fish, pse = 22.5). The remainder of the total catch consisted of LEGAL SIZE RELEASED fish (19,447). The latter, representing 43% of the total legal size fish caught, is similar to the proportion estimated from angler catch reports (49%).

Tables 8 and 9 display the estimated size distributions of catch by disposition in numbers and pounds, respectively. This report relied on the MRFSS estimate for HARVEST weight (567,531 lbs) while weight of SUB-LEGAL RELEASED (4,246,798 lbs) and LEGAL SIZE RELEASED (465,840 lbs) was approximated by the techniques and samples described in previous sections. Age and sex composition of the recreational catch was believed to have been similar to the description provided in Tables 4-6.

Estimation of Effort

Catch report information from anglers that did not sell any striped bass was examined to determine effort in this fishery. These reports indicated 31,480 h were spent catching 32,401 striped bass. The average hours per trip (from daily diaries) was 3.7 h, indicating trips totaled 8,508 (31,480 divided by 3.7). Assuming that catch and effort in these reports was proportional to the recreational fishery, total striped bass related trips in the recreational fishery was estimated at 152,860 ((582,129 fish divded by 32,401 fish) x 8,508 trips). Therefore, CPUE by trip and hour equal 3.8 and 1 fish, respectively. MRFSS 1991 preliminary estimate for total recreational fishing trips reaches nearly 3 million and suggests that less than 10% of anglers targeted striped bass. The estimate provided by the above approach (5%) then does not seem unreasonable.

Characterization of Losses

Using the same method and rates described in previous sections, 22,929 trips (catching a total of 87,319 bass) were assessed to have been involved in non-compliance (155,860 x 0.15).

The proportion of the total catch from these trips consisting of sub-legals was 13,971 fish (87,319 x 0.16). This established a poaching rate of 0.026 (13,971 divided by 536,723) and a conditional mortality rate (T) of 0.10. Total losses to both poaching and release mortality were then estimated at 55,791 striped bass (536,723 x 0.10). Since 25% of the total mortality rate (0.026 +0.08) was related to poaching, the total loss attributed to poaching was 13,697 fish (55,791 x 0.25), and the remainder, 42,094 fish, were lost as a result of release mortality (Table 10).

Other Losses

Although fishing with nets is generally prohibited in the Commonwealth's inshore areas, permits are occasionally issued for certain target species, gear types and fishing regions. As a condition of such permits fishermen must file detailed reports of their fishing activities and catch. A review of annual reports prepared by the DMF Statistical and Data Processing Project between 1987-1991, indicated none of these fisheries reported striped bass as bycatch.

NMFS sea-sampling information collected from gill net fisheries showed only nominal catches of striped bass (Gary Powers, pers. comm.). Several suspect fisheries, those with potential to result in high bycatch of striped bass or other highly regulated species, have developed over the years, but once identified the DMF has prohibited or heavily regulated their operation. Seasonal and areal closures to gillnetting, particularly during springtime south of Cape Cod, have been established chiefly to protect migratory stocks of juvenile striped bass.

Estimated Total Losses

Total estimated loss of striped bass during 1991 was 103,900 fish weighing 1,364,700 pounds (Table 11). Most was due to release and poaching mortality (65% by number and 41% by weight). About 80% of the total number lost were attributed to the recreational fishery (77% by weight). Figures D and E summarize losses by fishery in number and pounds, respectively. Since fish NOT SOLD documented in the commercial fishery are recreationally harvested fish, it was assumed this amount is reported as a portion of the recreational harvest. Therefore, accordingly, it was not entered in Table 11 under Commercial losses.

Figure D. Loss In Number

Figure E. Loss In Pounds

All sources of bycatch mortality, or mortality attributed to illegal fishing practices, have not been enumerated by this study. However, there is no evidence to suggest that the missing elements will far outweigh any values listed in Table 11. DMF regulatory procedures appear to blanket the potential for high bycatch rates to occur.
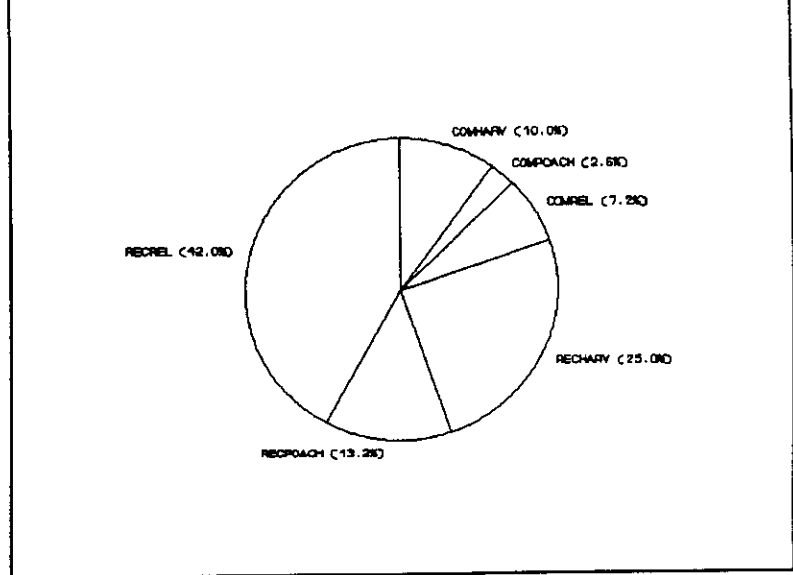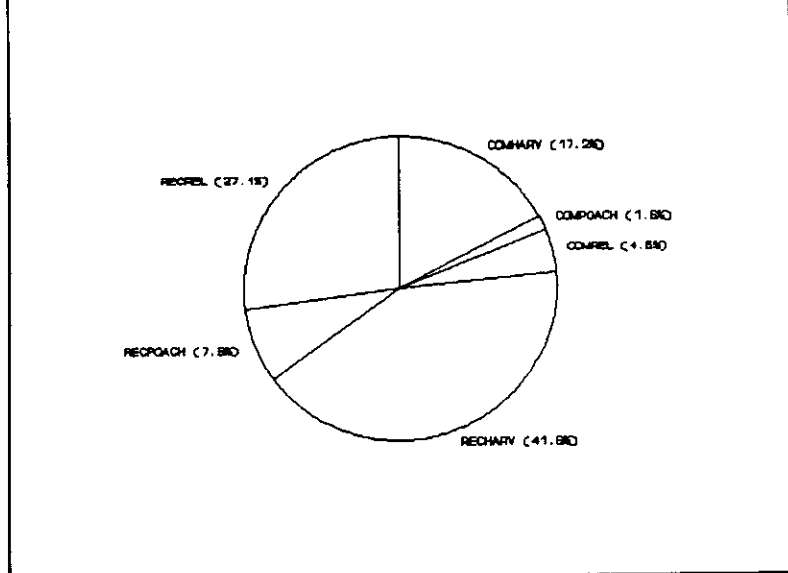
Required Fishery Independent Monitoring Programs

Massachusetts Tagging Study

Massachusetts began a striped bass tagging study in October 1991. Three hundred eighty seven fish were collected by rod and reel fishing aboard chartered vessels during 17 trips. Floy internal anchors tags supplied by the USFWS were used. The size and age composition has been described in previous sections (Tables 5 & 6).

TABLE 1.
DESCRIPTION OF DATA SOURCES

ORIGIN	NO. FISH	WEIGHT (LBS.)	USE
90 & 91 COMMERCIAL FISHERY	456	10,869	WEIGHT-LENGTH RELATIONSHIP
91 COMMERCIAL FISHERY	211	4,702	AGE & SEX COMPOSITION GROWTH RATE
MASSACHUSETTS TAGGING STUDY	346	4,361	AGE COMPOSITION GROWTH RATE
DEALER WRITTEN TRANSACTIONS	1,259	28,481	COMMERCIAL HARVEST ESTIMATE SIZE COMP. OF COMMERCIAL HARVEST
ANGLER CATCH REPORTS & DEALER WRITTEN TRANSACTIONS			COMMERCIAL CATCH OF SUB-LEGALS COMMERCIAL CATCH OF LEGAL SIZE RELEASED COMMERCIAL HARVEST NOT SOLD
ANGLER CATCH REPORTS	202 94 282 282	1,596 2,155 7,064 7,064	SIZE COMP. OF COMM. & REC. CATCH OF SUB-LEGALS SIZE COMP. OF COMM. & REC. CATCH OF LEGAL SIZE REL. SIZE COMP. OF COMM. HARV. NOT SOLD SIZE COMP. OF REC. HARVEST ESTIMATE OF COMMERCIAL EFFORT
MRFSS & ANGLER CATCH REPORTS			RECREATIONAL CATCH OF LEGAL SIZE REL. RECREATIONAL CATCH OF SUB-LEGALS ESTIMATE OF RECREATIONAL EFFORT
MRFSS			RECREATIONAL HARVEST ESTIMATE

TABLE 2.
ESTIMATED SIZE DISTRIBUTION OF THE MASSACHUSETTS COMMERCIAL
STRIPED BASS CATCH DURING 1991 (NUMBERS OF FISH).

*SIZE (TL)	SUB-LEGAL RELEASED	SOLD	NOT SOLD	LEGAL SIZE RELEASED	TOTAL	PERCENT	CUMM. PERCENT
12	1,422				1,422	1.3	1.3
13							1.3
14							1.3
15	1,422				1,422	1.3	2.5
16	3,318				3,318	3.0	5.5
17	948				948	0.8	6.4
18	6,162				6,162	5.5	11.9
19	1,422				1,422	1.3	13.2
20	4,266				4,266	3.8	17.0
21	948				948	0.8	17.8
22	3,792				3,792	3.4	21.2
23	4,266				4,266	3.8	25.0
24	7,584				7,584	6.8	31.8
25	4,266				4,266	3.8	35.6
26	5,688				5,688	5.1	40.7
27	474				474	0.4	41.2
28	6,162				6,162	5.5	46.7
29	948				948	0.8	47.5
30	8,532				8,532	7.6	55.2
31	3,792				3,792	3.4	58.5
32	6,162				6,162	5.5	64.1
33	6,636	16			6,652	6.0	70.0
34	8,532	165			8,697	7.8	77.8
35	8,532	511	22		9,065	8.1	85.9
36	474	899	65	108	1,546	1.4	87.3
37		2,712	532	836	4,081	3.7	90.9
38		2,069	598	378	3,045	2.7	93.7
39		668	228	189	1,085	1.0	94.6
40		701	315	189	1,205	1.1	95.7
41		322	261	351	933	0.8	96.6
42		181	130	81	393	0.4	96.9
43		190	120	27	336	0.3	97.2
44		289	283	108	679	0.6	97.8
45		247	43	0	291	0.3	98.1
46		478	185	27	690	0.6	98.7
47		305	65	27	397	0.4	99.1
48		231	98	135	464	0.4	99.5
49		157	43	54	254	0.2	99.7
50		157	43	27	227	0.2	99.9
51		49	11		60	0.1	100.0
52			11		11	0.0	100.0
53		25	11		36	0.0	100.0
54		8			8	0.0	100.0
TOTALS:	95,748	10,379	3,064	2,536	111,728		
AVE. SIZE	26.9	39.4	40.8	39.7	28.8		

*Each size is represented by an interval (i.e., size 12 contains fish measuring from 11.1 to 12 inches).

TABLE 3.

ESTIMATED SIZE DISTRIBUTION OF THE MASSACHUSETTS COMMERCIAL STRIPED BASS CATCH DURING 1991 (POUNDS OF FISH).

*SIZE (TL)	SUB-LEGAL RELEASED	SOLD	NOT SOLD	LEGAL SIZE RELEASED	TOTAL	PERCENT	CUMM. PERCENT
12	726				726	0.1	0.1
13							0.1
14							0.1
15	1,479				1,479	0.1	0.2
16	4,239				4,239	0.4	0.6
17	1,470				1,470	0.1	0.7
18	11,464				11,464	1.0	1.7
19	3,144				3,144	0.3	2.0
20	11,108				11,108	1.0	3.0
21	2,884				2,884	0.3	3.2
22	13,383				13,383	1.2	4.4
23	17,350				17,350	1.5	6.0
24	35,331				35,331	3.1	9.1
25	22,638				22,638	2.0	11.1
26	34,208				34,208	3.0	14.1
27	3,215				3,215	0.3	14.4
28	46,944				46,944	4.2	18.6
29	8,078				8,078	0.7	19.3
30	81,005				81,005	7.2	26.5
31	39,973				39,973	3.5	30.1
32	71,880				71,880	6.4	36.4
33	85,395	203			85,598	7.6	44.0
34	120,765	2,238			123,003	10.9	54.9
35	132,467	7,610	324		140,402	12.5	67.4
36	8,051	14,637	1,064	1,756	25,508	2.3	69.7
37		48,216	9,486	14,849	72,550	6.4	76.1
38		40,052	11,593	7,301	58,946	5.2	81.3
39		14,042	4,809	3,966	22,817	2.0	83.4
40		15,975	7,199	4,300	27,474	2.4	85.8
41		7,931	6,446	8,640	23,017	2.0	87.8
42		4,831	3,481	2,153	10,465	0.9	88.8
43		5,445	3,440	774	9,658	0.9	89.6
44		8,916	8,749	3,330	20,995	1.9	91.5
45		8,210	1,446		9,656	0.9	92.3
46		17,026	6,592	959	24,577	2.2	94.5
47		11,633	2,492	1,028	15,152	1.3	95.9
48		9,415	3,997	5,495	18,907	1.7	97.5
49		6,823	1,897	2,347	11,068	1.0	98.5
50		7,277	2,024	1,252	10,553	0.9	99.5
51		2,448	539		2,987	0.3	99.7
52			573		573	0.1	99.8
53		1,384	609		1,993	0.2	100.0
54		490			490	0.0	100.0
TOTALS:	757,200	234,800	76,760	58,150	1,126,910		
AVE. SIZE	7.9	22.6	25.0	22.9	10.1		

*Each size is represented by an interval (i.e., size 12 contains fish measuring from 11.1 to 12 inches).

TABLE 4.
AGE COMPOSITION OF STRIPED BASS SAMPLED FROM THE
MASSACHUSETTS COMMERCIAL FISHERY (JUL–AUG 1991).

AGE	NO.	PERCENT	TL	WEIGHT	1/SEX
7	14	6.6	36.1	16.6	10:0:4
8	57	27.0	37.0	18.3	39:1:17
9	81	38.4	37.8	19.7	54:2:25
10	15	7.1	38.9	22.0	11:0:4
11	5	2.4	41.1	25.3	4:0:1
12	5	2.4	41.9	27.7	3:0:2
13	1	0.5	42.0	25.2	1:0:0
14	4	1.9	43.4	30.2	2:0:2
15	9	4.3	43.6	30.8	8:0:1
16	4	1.9	43.5	29.9	3:0:1
17	5	2.4	42.8	30.4	4:0:1
18	8	3.8	47.2	40.9	8:0:0
19	2	0.9	45.9	38.2	2:0:0
20	1	0.5	49.6	40.5	1:0:0
	211		38.8	21.8	

1/FEMALE:MALE:UNKNOWN

TABLE 5.
AGE COMPOSITION OF STRIPED BASS SAMPLED FROM THE
MASSACHUSETTS TAGGING STUDY (OCT–NOV 1991).

AGE	NO.	PERCENT	TL	EST. WEIGHT
3	3	0.9	22.8	4.0
4	34	9.8	25.5	5.6
5	43	12.4	27.7	7.3
6	60	17.3	31.2	10.7
7	84	24.3	32.8	12.6
8	65	18.8	34.8	15.2
9	42	12.1	35.4	16.1
10	7	2.0	38.0	20.1
11	2	0.6	37.1	18.7
12	3	0.9	41.0	25.6
13				
14				
15	2	0.6	45.7	36.2
16				
17	1	0.3	49.5	46.8
	346		32.1	12.3

TABLE 6.
BACK-CALCULATED FORK LENGTH AT AGE FROM TAGGING STUDY AND COMMERCIAL SAMPLES

BACK-CALCULATED LENGTH AT AGE

1/GROWTH RATE	AGE	NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.28	3	3	132	302	451																	
0.69	4	34	141	294	440	546																
0.46	5	43	137	289	440	541	625															
0.37	6	60	135	304	447	547	632	710														
0.28	7	98	121	279	430	536	626	706	771													
0.20	8	122	140	311	453	564	647	722	793	845												
0.20	9	123	125	274	433	538	625	696	766	823	876											
0.13	10	22	132	264	408	516	621	703	773	834	885	921										
0.10	11	7	137	288	403	553	649	719	775	828	875	915	946									
0.07	12	8	133	282	415	527	637	731	813	870	914	942	973	995								
0.05	13	1	172	235	371	502	629	711	788	832	874	927	955	989	1,006							
0.05	14	4	151	296	427	542	646	729	804	861	902	942	970	995	1,016	1,033						
0.05	15	11	145	276	412	508	603	688	768	833	887	928	965	992	1,014	1,035	1,053					
0.04	16	4	155	286	408	508	603	693	769	830	876	917	944	964	987	1,008	1,025	1,039				
0.05	17	6	107	223	335	442	538	620	692	759	824	875	906	942	966	993	1,017	1,037	1,053			
0.03	18	8	120	240	371	457	586	676	757	840	893	940	976	1,008	1,034	1,061	1,083	1,101	1,117	1,129		
0.02	19	2	176	304	375	458	544	616	711	814	857	900	936	965	989	1,010	1,029	1,046	1,073	1,093	1,100	
0.04	20	1	115	211	352	465	569	648	726	826	891	947	988	1,016	1,041	1,057	1,075	1,096	1,122	1,143	1,171	1,186
WEIGHTED AVE:		557	132	288	435	541	629	706	775	834	879	923	956	986	1,007	1,030	1,049	1,065	1,090	1,124	1,124	1,186

	ESTIMATES	SE	CV
L_∞	1,175	16.0	0.0
K	0.159	0.00	0.0
t_0	0.148	0.12	0.8

1/TRUE GROWTH RATE (INSTANTANEOUS RATE OF INCREASE IN WEIGHT)

$= b(Lnl_2 - Lnl_1)$

Where, b = the weight:length exponent and

l_1 & l_2 are the back_calculation of length

at the last 2 annuli on the scale

TABLE 7.
ESTIMATED LOSSES DUE TO POACHING AND RELEASE MORTALITY
IN THE 1991 MASSACHUSETTS COMMERCIAL FISHERY.

SIZE (Tl)	REL. NO.	REL. POUNDS	POACH NO.	POACH POUNDS	TOTAL NO.	CUMM. PERC.	TOTAL POUNDS	CUMM. PERC.
12	108	55	40	21	148	1.5	76	0.1
13						1.5		0.1
14						1.5		0.1
15	108	112	40	42	148	2.9	154	0.3
16	252	322	94	121	346	6.3	443	0.8
17	72	112	27	42	99	7.3	154	1.0
18	468	871	175	327	643	13.6	1,198	2.4
19	108	239	40	90	148	15.0	328	2.8
20	324	844	121	316	445	19.4	1,160	4.2
21	72	219	27	82	99	20.4	301	4.5
22	288	1,017	108	381	396	24.3	1,398	6.2
23	324	1,318	121	494	445	28.6	1,813	8.4
24	576	2,684	216	1,006	792	36.4	3,691	12.8
25	324	1,720	121	645	445	40.8	2,365	15.6
26	432	2,599	162	974	594	46.6	3,574	19.8
27	36	244	13	92	49	47.1	336	20.2
28	468	3,567	175	1,337	643	53.4	4,904	26.1
29	72	614	27	230	99	54.3	844	27.1
30	648	6,155	243	2,307	891	63.1	8,462	37.2
31	288	3,037	108	1,139	396	67.0	4,176	42.1
32	468	5,461	175	2,048	643	73.3	7,509	51.1
33	504	6,488	189	2,433	693	80.1	8,921	61.7
34	648	9,176	243	3,440	891	88.8	12,616	76.7
35	648	10,065	243	3,773	891	97.5	13,838	93.2
36	45	759	13	229	58	98.1	988	94.4
37	67	1,242			67	98.8	1,242	95.9
38	30	611			30	99.0	611	96.6
39	15	332			15	99.2	332	97.0
40	15	360			15	99.3	360	97.4
41	28	723			28	99.6	723	98.3
42	6	180			6	99.7	180	98.5
43	2	65			2	99.7	65	98.6
44	9	278			9	99.8	278	98.9
45						99.8		98.9
46	2	80			2	99.8	80	99.0
47	2	86			2	99.8	86	99.1
48	11	460			11	99.9	460	99.6
49	4	196			4	100.0	196	99.9
50	2	105			2	100.0	105	100.0
TOTALS:	7,474	62,394	2,726	21,569	10,200		83,963	
AVE. SIZE:	27.3	8.3	26.9	7.9	27.2		8.2	

TABLE 8.

ESTIMATED SIZE DISTRIBUTION OF THE MASSACHUSETTS RECREATIONAL STRIPED BASS CATCH DURING 1991 (NUMBERS OF FISH).

*SIZE (TL)	UB-LEGAL RELEASED	EGAL SIZE RELEASED	ARVEST	TOTAL	PERCENT	CUMM. PERCENT
12	7,971			7,971	1.4	1.4
13						1.4
14						1.4
15	7,971			7,971	1.4	2.7
16	18,599			18,599	3.2	5.9
17	5,314			5,314	0.9	6.8
18	34,542			34,542	5.9	12.8
19	7,971			7,971	1.4	14.1
20	23,913			23,913	4.1	18.3
21	5,314			5,314	0.9	19.2
22	21,256			21,256	3.7	22.8
23	23,913			23,913	4.1	26.9
24	42,513			42,513	7.3	34.2
25	23,913			23,913	4.1	38.3
26	31,885			31,885	5.5	43.8
27	2,657			2,657	0.5	44.3
28	34,542			34,542	5.9	50.2
29	5,314			5,314	0.9	51.1
30	47,827			47,827	8.2	59.3
31	21,256			21,256	3.7	63.0
32	34,542			34,542	5.9	68.9
33	37,199			37,199	6.4	75.3
34	47,827			47,827	8.2	83.5
35	47,827		184	48,011	8.2	91.8
36	2,657	828	552	4,037	0.7	92.5
37		6,413	4,511	10,924	1.9	94.3
38		2,896	5,063	7,959	1.4	95.7
39		1,448	1,933	3,381	0.6	96.3
40		1,448	2,670	4,118	0.7	97.0
41		2,689	2,209	4,899	0.8	97.8
42		621	1,105	1,725	0.3	98.1
43		207	1,013	1,219	0.2	98.3
44		828	2,393	3,221	0.6	98.9
45			368	368	0.1	99.0
46		207	1,565	1,772	0.3	99.3
47		207	552	759	0.1	99.4
48		1,034	828	1,863	0.3	99.7
49		414	368	782	0.1	99.9
50		207	368	575	0.1	100.0
51			92	92	0.0	100.0
52			92	92	0.0	100.0
53			92	92	0.0	100.0
TOTALS:	536,723	19,447	25,959	582,129		
AVE. SIZE	26.9	39.7	40.8	28.0		

*Each size represents an interval (i.e., size 12 includes fish measuring from 11.1 to 12 inches)

TABLE 9.
ESTIMATED SIZE DISTRIBUTION OF THE MASSACHUSETTS RECREATIONAL
STRIPED BASS CATCH DURING 1991 (POUNDS OF FISH).

*SIZE (TL)	UB-LEGAL RELEASED	EGAL SIZE RELEASED	ARVEST	TOTAL	PERCENT	CUMM. PERCENT
12	4,070			4,070	0.1	0.1
13					0.0	0.1
14					0.0	0.1
15	8,294			8,294	0.2	0.2
16	23,777			23,777	0.5	0.7
17	8,243			8,243	0.2	0.8
18	64,299			64,299	1.2	2.1
19	17,632			17,632	0.3	2.4
20	62,301			62,301	1.2	3.6
21	16,177			16,177	0.3	3.9
22	75,061			75,061	1.4	5.3
23	97,310			97,310	1.8	7.1
24	198,157			198,157	3.8	10.9
25	126,969			126,969	2.4	13.3
26	191,859			191,859	3.6	16.9
27	18,034			18,034	0.3	17.3
28	263,289			263,289	5.0	22.3
29	45,305			45,305	0.9	23.1
30	454,319			454,319	8.6	31.7
31	224,189			224,189	4.2	36.0
32	403,144			403,144	7.6	43.6
33	478,943			478,943	9.1	52.7
34	677,320			677,320	12.8	65.5
35	742,951		2,397	745,349	14.1	79.6
36	45,157	14,064	7,869	67,090	1.3	80.9
37		118,953	70,132	189,086	3.6	84.5
38		58,492	85,711	144,203	2.7	87.2
39		31,773	35,554	67,327	1.3	88.5
40		34,446	53,229	87,675	1.7	90.1
41		69,215	47,663	116,878	2.2	92.4
42		17,249	25,736	42,985	0.8	93.2
43		6,198	25,430	31,628	0.6	93.8
44		26,679	64,683	91,362	1.7	95.5
45		0	10,691	10,691	0.2	95.7
46		7,686	48,737	56,423	1.1	96.8
47		8,232	18,423	26,655	0.5	97.3
48		44,020	29,555	73,574	1.4	98.7
49		18,805	14,029	32,834	0.6	99.3
50		10,029	14,963	24,991	0.5	99.8
51		0	3,985	3,985	0.1	99.8
52		0	4,239	4,239	0.1	99.9
53		0	4,505	4,505	0.1	100.0
TOTALS:	4,246,798	465,840	567,531	5,280,170		
AVE. SIZE	30.5	40.8	42.0	32.7		

*Each size represents an interval (i.e., size 12 includes fish measuring from 11.1 to 12 inches)

TABLE 10.
ESTIMATED LOSSES DUE TO POACHING AND RELEASE MORTALITY
IN THE 1991 MASSACHUSETTS RECREATIONAL FISHERY.

SIZE (Tl)	REL. NO.	REL. POUNDS	POACH NO.	POACH POUNDS	TOTAL NO.	CUMM. PERC.	TOTAL POUNDS	CUMM. PERC.
12	625	319	203	104	829	1.4	423	0.1
13						1.4		0.1
14						1.4		0.1
15	625	650	203	212	829	2.9	862	0.3
16	1,459	1,865	475	607	1,933	6.3	2,471	0.8
17	417	646	136	210	552	7.2	857	1.0
18	2,709	5,043	881	1,641	3,590	13.5	6,684	2.4
19	625	1,383	203	450	829	14.9	1,833	2.7
20	1,875	4,886	610	1,590	2,486	19.3	6,476	4.1
21	417	1,269	137	413	554	20.2	1,681	4.4
22	1,667	5,887	542	1,915	2,209	24.1	7,802	6.1
23	1,875	7,632	610	2,483	2,486	28.4	10,115	8.2
24	3,334	15,541	1,085	5,056	4,419	36.1	20,597	12.5
25	1,875	9,958	610	3,240	2,486	40.5	13,198	15.3
26	2,501	15,047	814	4,896	3,314	46.2	19,943	19.4
27	208	1,414	68	460	276	46.7	1,875	19.8
28	2,709	20,649	881	6,718	3,590	53.0	27,367	25.5
29	417	3,553	136	1,156	552	53.9	4,709	26.5
30	3,751	35,631	1,220	11,593	4,971	62.6	47,224	36.4
31	1,667	17,583	542	5,721	2,209	66.5	23,303	41.3
32	2,709	31,618	881	10,287	3,590	72.7	41,905	50.0
33	2,917	37,562	949	12,221	3,867	79.5	49,784	60.4
34	3,751	53,121	1,220	17,283	4,971	88.1	70,404	75.2
35	3,751	58,268	1,220	18,958	4,971	96.8	77,226	91.3
36	274	4,344	68	1,152	342	97.4	5,496	92.4
37	513	9,518			513	98.3	9,518	94.4
38	232	4,680			232	98.7	4,680	95.4
39	116	2,542			116	98.9	2,542	95.9
40	116	2,756			116	99.1	2,756	96.5
41	215	5,538			215	99.5	5,538	97.7
42	50	1,380			50	99.6	1,380	98.0
43	17	496			17	99.6	496	98.1
44	66	2,135			66	99.7	2,135	98.5
45						99.7		98.5
46	17	615			17	99.7	615	98.6
47	17	659			17	99.8	659	98.8
48	83	3,522			83	99.9	3,522	99.5
49	33	1,505			33	100.0	1,505	99.8
50	17	802			17	100.0	802	100.0
TOTALS:	43,649	370,017	13,697	108,366	57,346		478,383	
AVE. SIZE	27.4	8.5	26.9	7.9	27.3		8.3	

TABLE 11.
PRELIMINARY ESTIMATES OF STRIPED BASS LOSSES
IN MASSACHUSETTS FOR 1991.

CATEGORY	NUMBER	POUNDS	AVE. SIZE
1/COMMERCIAL			
LEGAL HARVEST	10,379	234,800	22.6
POACHING	2,726	21,569	7.9
RELEASE	7,474	62,394	8.3
RECREATIONAL			
LEGAL HARVEST	25,959	567,531	21.9
POACHING	13,697	108,366	7.9
RELEASE	43,649	370,017	8.5
TOTALS:	103,884	1,364,677	13.1

1/Harvest NOT SOLD from Tables 2 & 3 is not
recorded here, since this type of harvest is most
likely already estimated as part of the rec. leg.
harvest.

APPENDIX I.

Estimating a Tag Reporting Rate
for striped Bass Recaptures
in Massachusetts Waters

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Introduction

Over the past decade, information provided by coastal fishermen has helped establish

valuable baseline population parameters for east coast striped bass (*Morone saxatilis*) stocks.

Many of the stripers tagged and released by the cooperative efforts of state and federal

agencies are recaptured by fishermen using hook-and-line (USDOI and USDOC, 1989). A

substantial hook-and-line fishery for striped bass is conducted along the Massachusetts coast

from early spring to late fall (Diodati, 1986). Information from the 1990 commercial fishery

indicates more than 60,000 bass were caught and released by anglers during July through

September (Diodati and Hoopes 1991). Consequently, a substantial number of tag recaptures

in past years have been reported from Massachusetts waters (Dorazio and Rago, 1989). This

study attempts to characterize the reporting habits of Massachusetts striped bass anglers by

approximating a tag recapture reporting rate. Such information will assist scientists in refining

estimates of the absolute rates of exploitation.

Methods

Fishing for striped bass in Massachusetts is restricted to hook-and-line. Fishermen wishing to sell any portion of their harvest must purchase a commercial fishing permit as well as a special striped bass fishing permit and they must submit fishing reports at the end of the fishing season. The 1990 and 1991 list of permit holders provided the survey population for this study. Following the close of the 1990 commercial fishing season all permit holders were surveyed by mail. The survey questions required a voluntary and anonymous response to be mailed back to the DMF (Attachment 1). During 1991, the survey was conducted by appending several questions to the catch report (Attachment 2). Therefore, 1991 survey responses were not anonymous and the voluntary nature embodied in the 1990 portion of the study was eliminated. Survey results for each year and for years combined were used to estimate reporting rates.

Since fishermen that responded to the survey (respondents) were judged to be more likely to report recaptures than individuals that did not (non-respondents), the report rate derived from respondents was regarded as a *maximum reporting rate*. To estimate a *minimum reporting rate*, a value of zero was assigned to non-respondents and a weighted average report rate for respondents and non-respondents was calculated. A geometric mean of the resulting minimum-maximum values was used to estimate the average reporting rate (Rt).

Results and Discussion

A total of 3,081 surveys were distributed, 1,342 in 1990 and 1,739 in 1991. Survey respondents totaled 1,980 (64%). Most (1,373), were from the 1991 portion of the study. The 1990 results showed that 163 of 209 recaptures were reported. Thus establishing a *maximum report rate* of 78%. After assigning a report rate of zero to 735 non-respondents, a *minimum report rate* of 35% was estimated (0.78 times 607 plus 0.00 times 735 divided by 1,342). A geometric mean of 53% (Rt) was determined from the resulting minimum and maximum values

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(35% and 78%). The 1991 portion of the study showed that 294 tagged striped bass were recaptured and 260 were reported, establishing a *maximum report rate* of 88%. With a report rate of zero assigned to 366 non-respondents, a *minimum report rate* of 70% was estimated (0.88 times 1,373 plus 0.00 times 366 divided by 1,739). The mean value of Rt from the 1991 portion of the study was 79%. By combining 1990 and 1991 results, a *minimum and maximum report rate* of 54 and 84% was derived. An average Rt of 67% was estimated as the geometric mean of these values.